Portfolio 8

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PART 1

Interpretation + Reflection

Figure 1.1 depicts the participants ERP response to positive and negative images, respectively in the occipital lobe. More specifically, the Oz channel is recording from the central occipital lobe, thus reflecting early stages of visual processing.
The negative deflections at around 170 ms could be an example of an effect for face-specific processing. This is also known as the N170, which is generally observed in EEG when faces are processed.
When comparing figure 1.2 and 1.3, it looks like there is greater activation (or greater fluctuation from the baseline) for the negative images. Note that we also see a larger decrease in the occipital lobes, which we plotted in figure 1.1 from channel OZ.

Figure 1.1 channel Oz

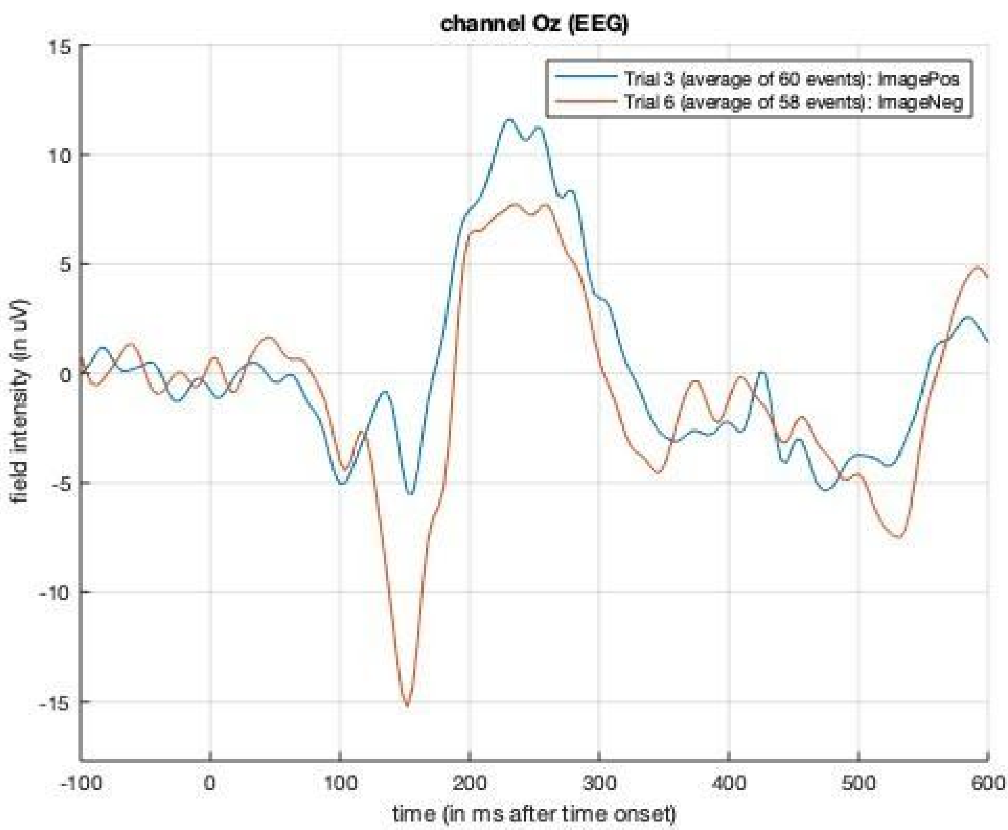


Figure 1.2 ImagePos at 172 ms for a single participant

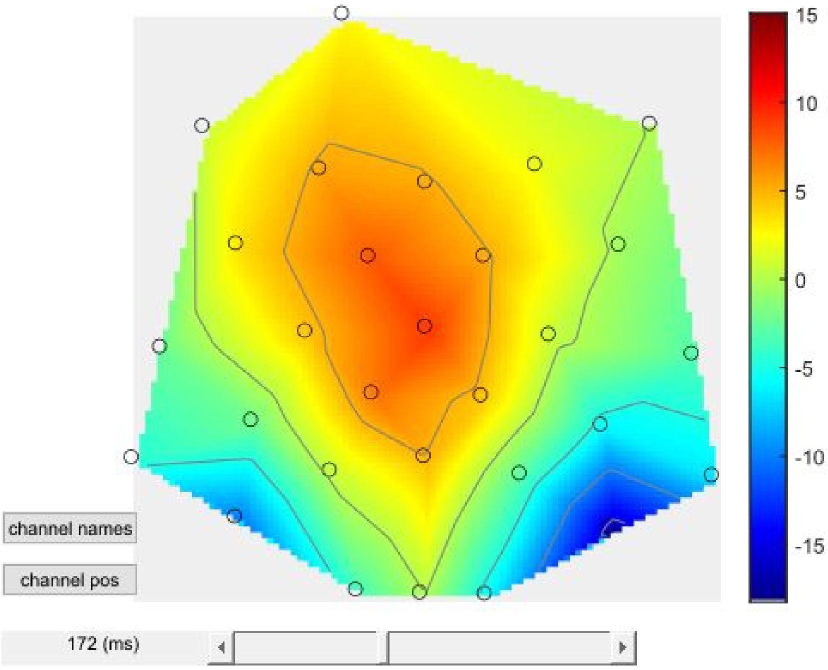
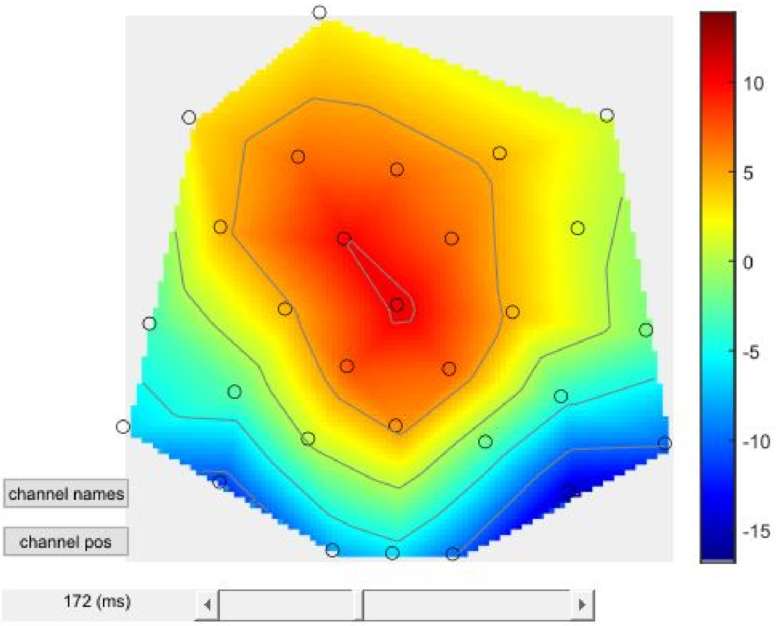


Figure 1.3 ImageNeg at 172 ms for a single participant



PART 2

Interpretation + reflection

We have chosen to report from channel T7 and Fp1 when looking at the effects of WordPos, WordNeg and WordNeu. T7 measures from the left temporal lobe and Fp1 measures from the prefrontal cortex. We expect words to be processed in the temporal lobe, more specifically in the left lateralized temporal lobe, which is why we have chosen to report from T7 and not the T8, which is in the right temporal lobe. We also expect words to elicit an activation in the prefrontal cortex, because we add contexts to words we read.
See figures 2.1 and 2.2. on the next page.

In the figure below (2.1) an increased activation can be seen in channel T7 beginning from approximately 350 ms after onset of the word, and steadily increasing until 530 ms after onset. After the increased activity in T7 the processing of the word moves to the Fp1 channel (figure 2.2) where the activation increases up to an amplitude of +10 nanoVolt. This might be explained by the participant processing the word and putting it in a broader context. But 530 ms after onset is a relatively long time, so we do not know how reliable this is.

We also see a difference in signals from neutral, positive and negative words at approximately 500 ms after onset in Fp1; thus, the prefrontal cortex might be involved in the processing of word valence.

Contrasting the processing of words, with the processing of images, we generally see a more anterior activation (e.g. temporal lobe and frontal lobe). We also see an activation at later time points (e.g. 350 ms instead of 170 ms). These results go well together with a hierarchical processing model, where more complex stimuli are processed more anteriorly in the brain and at a later stage.

If we chose to continue the analysis only looking at the two aforementioned channels, we would throw away a lot of data. We would prefer not to do that.
Choosing channels like this after looking at the data is a way of “fishing” for results. When doing studies you should always hypothesize where activation would be found before conducting the analysis, because there is a chance that the significant activations that are found are random. Exploratory analysis of EEG data therefore have a high chance of finding false positives.
By looking channels post-hoc we are almost bound to find some significant results sooner or later; but this is a big no-no.

Figure 2.1 Channel T7

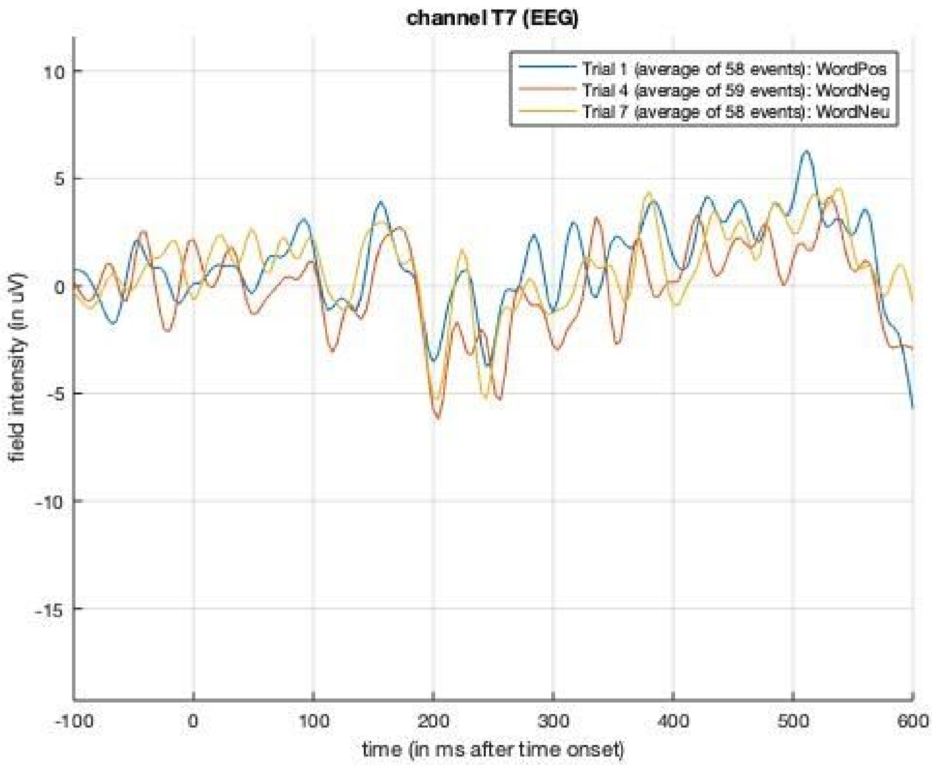
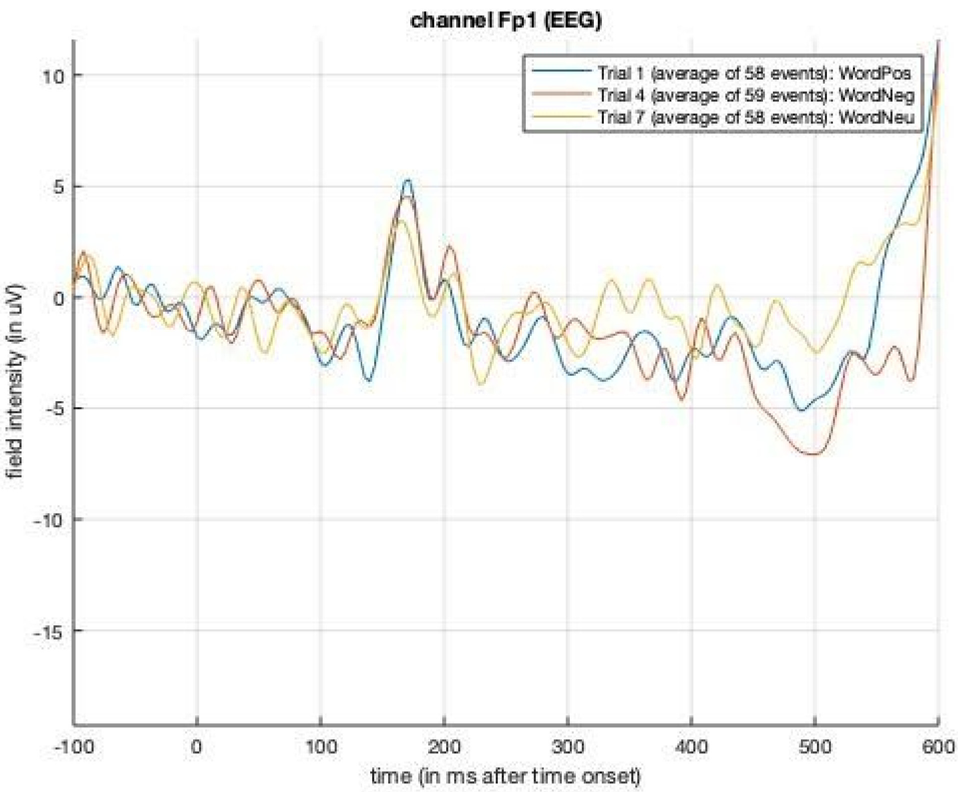


Figure 2.2 Channel Fp1



PART 3

Plots for the first three contrasts in O1 and O2, respectively, of the low-pass filtered group-average.

Figure 3.1 Channel O1

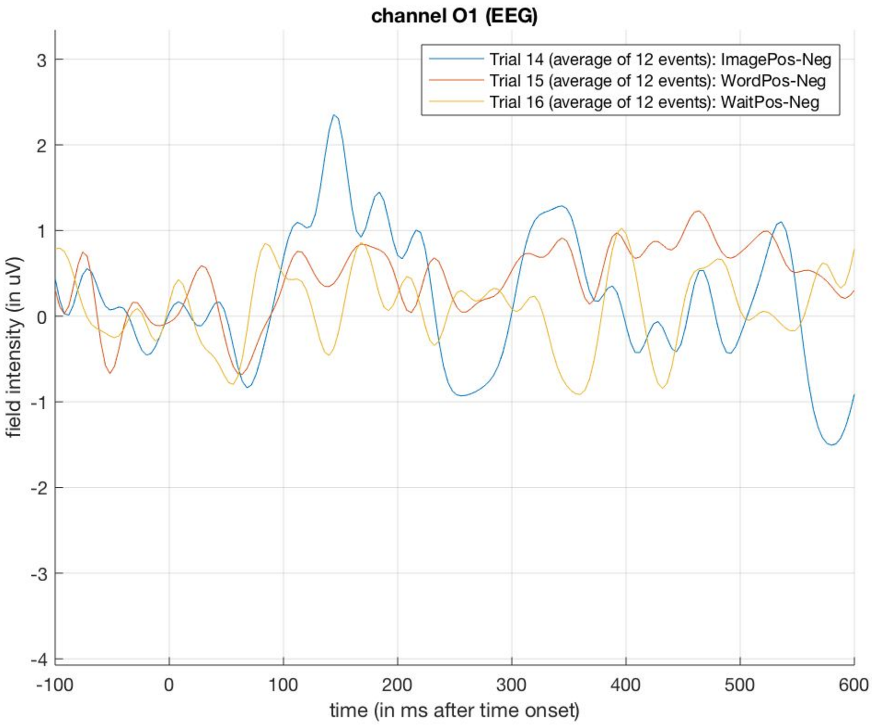
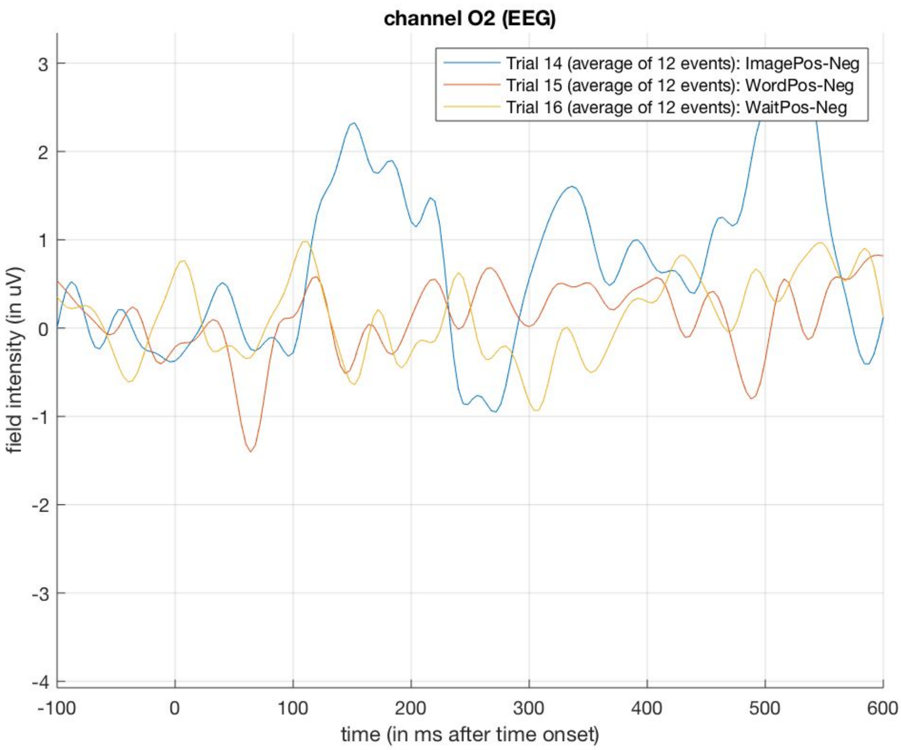


Figure 3.2 Channel O2



Interpretation:
In general, we interpret contrasts in these terms: If the field intensity for ImagePos-Neg at a given time point is positive it means that positive images have a stronger signal. On the other hand, if the field intensity is negative, is means that negative images have a stronger signal at the given time point.

Approximately 150 ms after presentation of an image, there is a substantially higher activation in the ImagePos-condition versus the ImageNeg-condition, both in O1 and O2 (figure 3.1 and 3.2). After 250 ms, the activation after seeing a negative face is higher in both occipital areas. Thus, the two areas have a similar pattern of activation to some extent. However, when comparing channel O1 and O2, we see that the signal for ImagePos-Neg at approximately 150 ms has a similar amplitude at approximately 2 μv. At this peak there is a difference in the area under the curve; i.e. the integral of the peaks in O2 is larger than the integral of the peak in O1. We also see this increased area under the Image-Pos-Neg curve in O2 at approximately 330 ms and 530 ms. This could indicate, that positive images are processed more in channel O2 than in O1 at 150 ms. However, we do not know any theory that would support this notion of valence specific processing in the right occipital lobe. Why would the right occipital lobe process positive faces to a greater extent than left occipital lobe? Processing of valence would more likely take place in higher cortical areas such as temporal or frontal lobe.

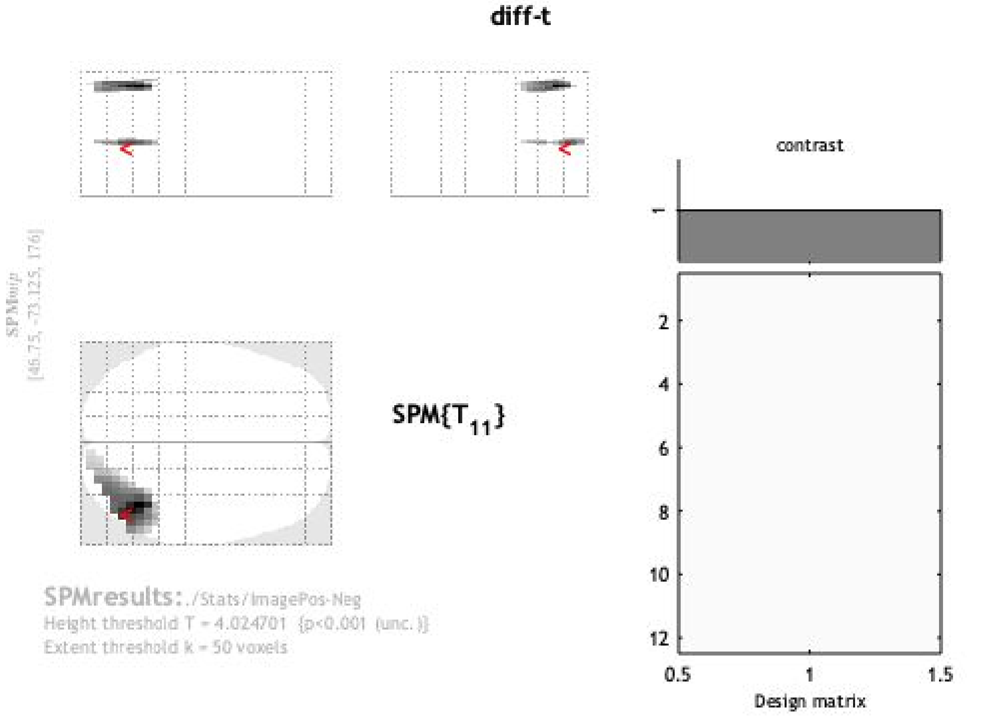
Reflection:
The risk of relying too heavily on difference waves (i.e. contrasts) is that when you subtract two waves from one another, you lose the level of amplitude for the individual waves. I.e. if the plot below shows an amplitude of 0, it means that the two waves have an equally high activation, though in different directions. It does not say anything about how big this activation is. The two waves could have high activation, baseline activation or negative activation, but the figure only shows whether or not the amplitude of the waves are equal or not. Thus, in essence you risk throwing away data by collapsing several signals, which can lead to false conclusions being drawn.

PART 4

<u>Interpretation + reflection</u>

Reporting the stats output tables of the contrast ImagePos-Neg with different t-contrasts and one f-contrast. We have chosen the ImagePos-Neg contrast, because we would like to investigate the effect of positive and negative faces, respectively.

Figure 4.1 One-sample t-test for ImagePos-neg (diff-t as t-contrast)



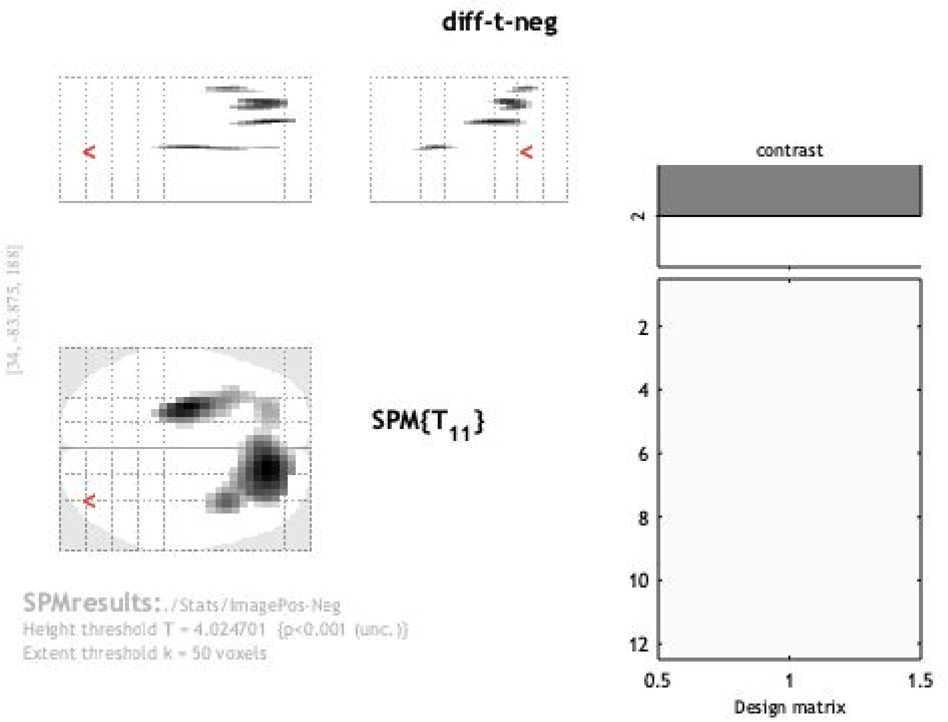
Statistics: *p-values adjusted for search volume*

set-level		cluster-level				peak-level					mm mm ms
p	c	$p_{FWE-corr}$	$q_{FDR-corr}$	k_E	p_{uncorr}	$p_{FWE-corr}$	$q_{FDR-corr}$	T	(Z_E)	p_{uncorr}	
0.253	2	0.040	0.045	419	0.015	0.277	0.406	6.09	3.95	0.000	42 -62 520
						0.527	0.406	5.25	3.64	0.000	38 -62 500
						0.551	0.406	5.18	3.61	0.000	42 -68 540
		0.174	0.107	209	0.072	0.496	0.406	5.33	3.67	0.000	51 -68 188
						0.691	0.439	4.81	3.46	0.000	34 -84 188

We have conducted a one-sample t-test to investigate if our difference wave (contrast) is significantly different from 0. Results can be found in the figure above (4.1). In this case, we have used the diff-t contrast.

There is a significant higher activation in the right occipital lobe 520ms after onset, for positive images compared to negative images. This result corresponds well with the result from part 3, where we see more activation for positive images in channel O2 (figure 3.2) than in channel O1 (figure 3.1). Again, this suggests that the right occipital lobe process positive images (faces) more than it processes negative images, which we find odd.

Figure 4.2 One-sample t-test for ImagePos-Neg (diff-t-neg as t-contrast)



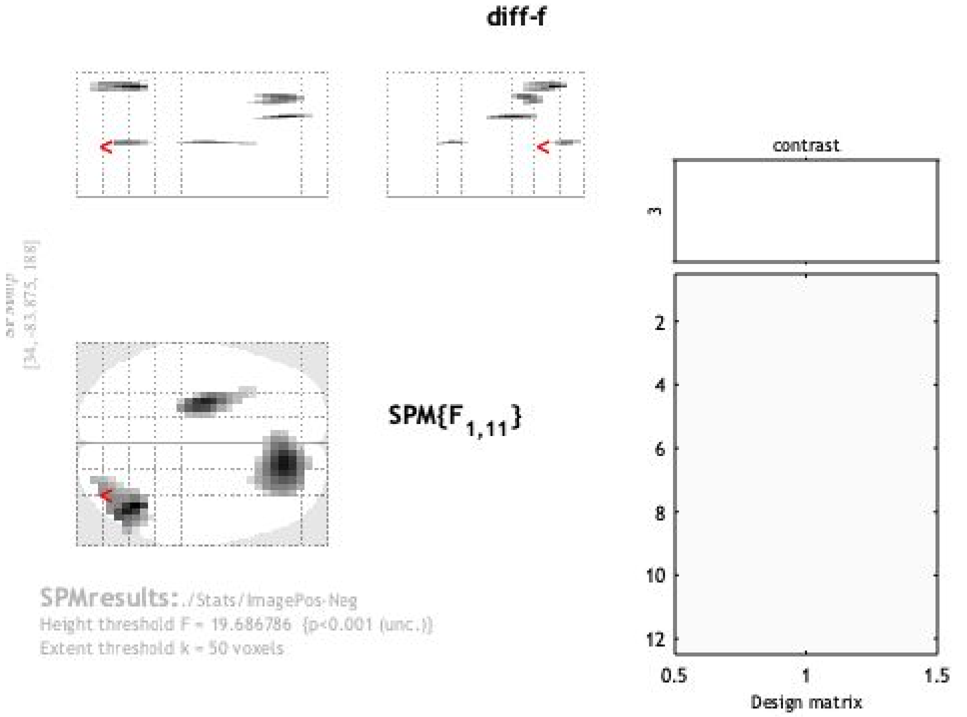
Statistics: *p-values adjusted for search volume*

set-level		cluster-level				peak-level					mm mm ms
p	c	$p_{FWE\text{-}corr}$	$q_{FDR\text{-}corr}$	k_E	p_{uncorr}	$p_{FWE\text{-}corr}$	$q_{FDR\text{-}corr}$	T	(Z_E)	p_{uncorr}	
0.017	4	0.053	0.097	376	0.020	0.316	0.674	5.92	3.89	0.000	17 40 340
		0.176	0.168	208	0.072	0.340	0.674	5.83	3.86	0.000	-26 -14 192
						0.796	0.743	4.52	3.33	0.000	-26 40 188
		0.071	0.097	332	0.028	0.452	0.674	5.46	3.72	0.000	26 40 456
						0.536	0.674	5.22	3.63	0.000	30 34 428
		0.243	0.182	166	0.104	0.594	0.674	5.07	3.57	0.000	38 13 544
						0.788	0.743	4.54	3.34	0.000	30 18 520

When using the diff-t-neg contrast, it reverses the contrast. This means that we are now looking at ImageNeg-Pos instead of ImagePos-Neg or in other words if ImageNeg is significantly more activated than ImagePos.

In figure 4.2 it is seen that there is a significantly higher activation in the frontal lobes (primarily right) for negative images compared to positive images. In addition to this, there is also a higher activation in the left parietal lobe.

Figure 4.3 One-sample t-test for ImagePos-Neg (f-contrast)



Statistics: *p-values adjusted for search volume*

set-level		cluster-level				peak-level					
p	c	$p_{FWE-corr}$	$q_{FDR-corr}$	k_E	p_{uncorr}	$p_{FWE-corr}$	$q_{FDR-corr}$	F	(Z_E)	p_{uncorr}	mm mm ms
0.004	5	0.072	0.163	273	0.021	0.477	0.730	37.06	3.78	0.000	42 -62 520
						0.776	0.730	27.55	3.46	0.000	38 -62 500
						0.798	0.730	26.87	3.43	0.000	42 -68 540
		0.118	0.163	219	0.036	0.532	0.730	35.10	3.72	0.000	17 40 340
		0.430	0.329	89	0.162	0.564	0.730	34.04	3.69	0.000	-26 -14 192
		0.156	0.163	190	0.049	0.700	0.730	29.83	3.54	0.000	26 40 456
						0.785	0.730	27.28	3.45	0.000	30 34 428
		0.435	0.329	88	0.164	0.746	0.730	28.46	3.49	0.000	51 -68 188

The results of the F-contrast is depicted above in figure 4.3.

The diff-f contrast is in a sense a two-tailed significance test. This is a mix of diff-t and diff-t-neg. The significant activation seen in the figure is the same areas as in both diff-t and diff-t-neg. Hence, these are the areas where the voxels can explain a significant portion of variance in the data. But the F-contrast does not have a direction; i.e. we cannot say whether these areas are due to positive or negative images. In other terms, these areas show where our model has significant “power”, but it does not reveal whether there is any “effect” in these areas.

PART 5

<u>Reflection:</u>

We think that it is quite surprising that, even though EEG is said to have poor spatial resolution, we can still interpret on different brain areas (e.g. occipital lobe, temporal lobe and frontal lobe), and not only interpret the temporal dimension.

It was quite cool to find alpha-waves, however, we are a bit disappointed that no Alpha King or Queen has been chosen.